THE MAGNAVOX COMPANY

URBANA, ILLINOIS

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(From 1 February to 28 February 1963)

5 March 1963

SOLID-STATE ARM SAFE DEVICE (PHASE III)

CONTRACT DA-11-022-ORD-4048

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J. O. 51361 5 March 1963

PROJECT DEFINITION

The purpose of this third phase four-month program is to design, develop and fabricate at least three miniature electronic Solid State Arm Safe Devices capable of functioning in various warheads for Army missiles under a wide range of environmental conditions. The first outputs must activate a squib at a preselected acceleration. The second output is to have a Solid State switching circuit which will provide an electrical change of state after the missile has traveled a preselected distance from the launch site.

SCOPE

The three (3) miniature Solid State Arm Safe Devices will have the following properties:

1) Maximum acceleration - up to 40 g's.

2) Total time before arming - up to 100 seconds.

3) Total distance in flight before arming - up to 100,000 meters.

4) Vibration 21 to 700 cps at ± 10 g's for ten (10) minutes in each of three (3) orthogonal axis.

5) Maximum temperature range -65°F to +200°F.

6) 95% humidity for six (6) hours at 160°F.

7) The volume of the miniature units shall not exceed two (2) cubic inches; and the weight shall not exceed six (6) ounces.

8) The size of the units shall be cylindrically shaped (1.5 inches in diameter and approximately one inch high).

9) The solid state circuits shall not require more than 6 volts (5.6 volts) with a current drain of no more than 200 milliamperes.

10) The miniature models must withstand a 400 g drop for a period of one (1) millisecond regardless of impact orientation.

11) The miniature Solid State Arm Safe Device shall have one (1) output switch which shall be activated as a function of a particular accelera-

tion; the other output switch shall be activated as a function of distance. An attempt will be made to receive acceleration switchings with an accuracy to within ±2%. The distance accuracy must be less than ±25%.

12) The solid state devices shall be classified as demonstration units which shall have small connectors compatible with the miniaturization scheme.

Performance of the above program of work shall be under supervision of the Technical Supervisor (Picatinny Arsenal).

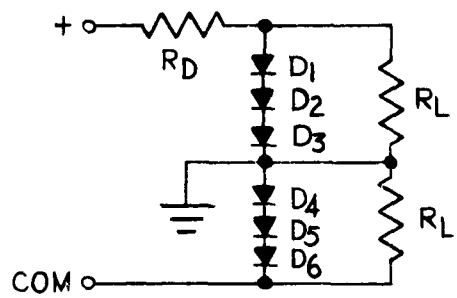
The above work shall be accomplished on or before May 7, 1963. An additional 30 days will be allowed for the preparation and submission of the Final Summary Report required to be furnished under the contract.

TECHNICAL DISCUSSION

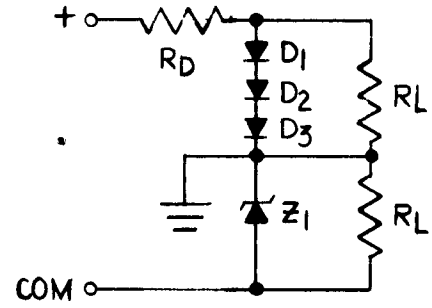
Transducer: Transducer design remains essentially unchanged. Spherical mass size has been increased from 1/4" to 5/16" in diameter. This was done to provide more mass weight and, therefore, a larger beam thickness can be used and still achieve the same output. Any increase in beam thickness results in reduced machining problems as well as making the beam less sensitive to variances in the gage bonding procedure.

Some thought has been given to the use of the two gage beam. This allows us to increase the thickness of the beam even further without deteriorating output. Better stability over the temperature range of operation is obtained with two gages mounted on opposite sides of the beam. This method does require fine matching of the zero strain, R_o resistances of the gage pair.

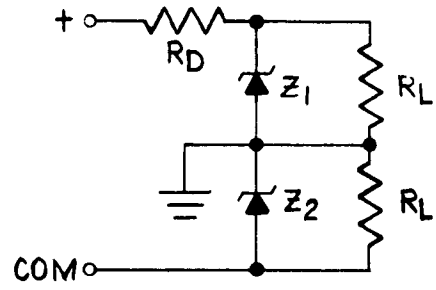
Voltage Regulator: Several schemes were tried and a final circuit has been developed. The three circuits investigated are shown in Figure 1.



A. Series Diode Regulator



B. Series Diode-Zener Regulator



C. Series Zener Regulator

FIGURE 1. VOLTAGE REGULATOR CIRCUITS

Each circuit had its good and bad points and further study evolved the circuit of Figure 2.

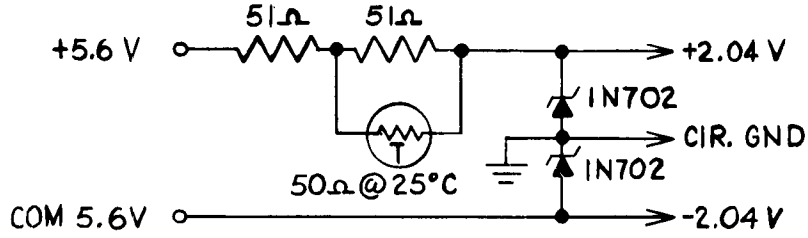


FIGURE 2. FINAL VOLTAGE REGULATOR

This voltage regulator is quite stable (±.010 volts) over the temperature range of -75°F to +225°F.

Operational Integrators: Finalizing of these circuits are in the last stages. Excellent low temperature stabilization has been accomplished. Design work is being completed on high temperature compensation.

WORK TO BE ACCOMPLISHED

The first miniature model will be ready for delivery to Picatinny Arsenal on or before April 1, 1963. The other miniature models are in various stages of fabrication but will be delivered on schedule.

HOURS EXPENDED DURING REPORT PERIOD

Engineering	11.0
Technician	144.0
Services	53.5
	208.5